

Intellectual Attitude in Building Services Design in the Pavilion of Spain at the New York World's Fair

The constructed architecture and exhibitions inside the pavilions erected at international exhibitions are logical and necessary starting points for studying the design process that lead from the program to its implementation.

The analysis of these elements, though indispensable for the study of a set of cases, usually focuses on the final stage, or at least in a theoretical outline focused on the architectural conception of the 'idea'.

Obviously the reality is much more complex, so it becomes indispensable to obtain a holistic view of what was happening in twentieth-century Spanish architecture, by incorporating actions and agents that enhance the knowledge of what happened.

In the present case, the Spanish Pavilion at New York, designed by Javier Carvajal, what is of interest is that it had to be built 'over there', taking into account the high quality requirements imposed by US regulations, with Spanish means and engineers from 'over here'.

If that 'there/here' distance had been excessive, the execution of the project would have suffered, and resulted in something different. But Javier Carvajal was lucky enough to have a brilliant Spanish engineering team, who also had ample experience of working in USA military bases in Spain, so their knowledge of techniques and technologies was the same as what could be found on the other side of the Atlantic.

From the architectural point of view, all this tells an exciting story of how a Spanish architect and some engineers were able to design, calculate and execute a project carried out in the United States, and maintain the levels of aesthetic and technical quality as planned in their Madrid workshops.

In other words, it is a truly international project since the physical and intellectual boundaries did not cause any problems, obstacles or constraints, because the engineers involved were perfect connoisseurs of energy systems and the most advanced building services of the moment.

These systems provide the basic storyline for this text, but they must not hide the brilliance of the intellectual attitude towards joint work which permitted the architect and engineers to come up with a remarkable solution.

1. The project

The triumph of the Spanish Pavilion may be a surprise, but not an accident.

The sixties provided several buildings of interest due to the way they integrated the air conditioning, which means a consolidation of this technical knowledge in Spanish architecture, and, in this context, the Javier Carvajal 's Pavilion of Spain is a building about which much was written "in the American press [...] offering the highest praise ... The Pavilion of Spain not only is the best, it is also the only one that is architecture at the New York Fair" ². This was also confirmed by the press of the time in the following terms:

Many people believe the Spanish Pavilion to be the best quality building of the Fair. It was designed by the architect Javier Carvajal and has received a meticulous support from the New York consulting firm Kelly & Gruzen. [...] The simple exterior does not anticipate the dark, rich interior, splashed masterfully by the light of the patios.

The Pavilion of Spain, designed by Javier Carvajal, is exceptional from every point of view, including both the building and what is exhibited inside. The exterior aspect is unadorned, almost harsh, a play of contrasting masses with rough, white, closed-in walls forming the lower part and well-placed grey blocks in the upper part.

Elegant but severe, it is a sight for eyes that are confusion of the colors and shapes of other sites.

It is the largest foreign pavilion of the Fair, but to realize this I had to read it in the guide, given its comfortable distribution. Its interior is an architecturally charming puzzle, a wonderful paradise, with something new to discover around every corner. The future of the Spanish pavilion is what now worries me. It would be a real shame for the building to disappear when the fair is over.

The Spanish pavilion for the World Fair at New York is a work which was then controversial, since the project began as a result of a limited competition among invited architects, without notification to the Council of Colleges of Architects⁷. The disagreement continued due to the narrow margin of twenty days given for the preparation of the preliminary draft and was further accentuated with the controversial

¹ 'Architectural Forum', June 1964.

² WAA. "J. Carvajal. Arquitecto", COAM Publishing Service, 1991, p.57.

³ See e.g. "Architecture at the New York World's Fair". 'Architectural Record', July 1964, p.143.

⁴ RAMÍREZ DE LUCAS, Juan (1964). Collected in en WAA. "J. Carvajal", op. cit, p.58.

⁵ WAA. "J. Carvajal", op. cit, p.60.

⁶ JONES, Will. 'Minneapolis Morning Tribune', May 22, 1964. Collected in WAA. "J. Carvajal", op. cit, p.60. This last will advanced the reconstruction of the building in St. Louis that took place soon after.

⁷ See e.g. FULLAONDO, J. D. "La bicicleta aproximativa", op. cit, p.87.

decision of the jury. Carvajal carried off the first prize with an original work that is not well understood at the time: a neutral, anonymous, sober and elegant pavilion, lacking emphasis, in its prism-like and landscaped forms, easily assembled and recoverable by prefabrication systems⁸. In fact, this latter quality allowed the building to be acquired at the end of the Fair by Saint Louis City through its Mayor A. J. Cervantes⁹, and rebuilt to celebrate 'the City's Colonial Spanish Heritage'. The pavilion was an attraction for some years, and in 1973, a hotel was built in its backyard.

A project fully defined in Madrid by a Spanish architect and Spanish engineering¹⁰.

2. The building

The pavilion of Spain was located in the main conglomerate of the Fair next to other pavilions.

Basically the pavilion had two floors, a ground floor entrance and a multipurpose room on the first floor; it also had a kitchen and several dining areas (of great importance during the Fair). The rest of the building was free for exhibition areas. For the development of these indoor exhibitions of the Spanish Pavilion, Javier Carvajal collaborated with various technicians and artists.

Although the technical design of the pavilion was done entirely in Spain, during the construction of the pavilion at the Fair, which took just nine months, they had to make some modifications due to the requirements of the regulations of the Fair itself, so Carvajal had, among others, the collaboration of the American architects Lloyd H. Siegel and Rolland Thompson from the New York consulting firm 'Kelly & Gruzen'.

In its construction, the building was put together like a giant Meccano with a metallic structure and a facade of prefabricated concrete panels which greatly facilitated, as will be seen, the pavilion assembly and the integration of the various building services required for the operation.

⁸ See e.g. Urrutia, Á. "Arquitectura Española", op. cit, p.491.

⁹ At the end of the international exhibition, at the suggestion of Robert Moses, president of the Fair, all flags must be destroyed to make way for large Flushing Meadow Park. However, it is so overwhelming the Spanish flag victory born a platform to be retained. Two cities bid for the building: St. Louis and Atlanta. Finally in September 1965 moved and rebuilt in the city of St. Louis.

¹⁰ The wording of this text, as well as the documentation that illustrates, is indebted to the discussions and help provided by Carlos Morales [Conversation with Carlos Morales, February 22, 2007] and Manuel de Cos [Conversations with Manuel Castillo, February 26 and May 21, 2007].

3. Building services

In our field of architecture many technicians with different skills have their place, leaving aside any false demagoguery about equality or democracy; they are asked to realize the project: the only condition is that they respect it, and understand that the architectural project, the generator and integrator of this architecture, is much more than a drawing and the architect more than an irresponsible artist¹¹.

The previous comment clearly reflects the importance that Javier Carvajal gave to the integration of installations in the building, which is not a surprise, since those who knew him point out his concern for technology:

I do not think it is required to remember the constantly proven Carvajal rationalistic parameter, [...] the technological attention revealed in the early incorporation, one of the first in Spain, of the air conditioning installation, for example.

Regarding the engineering team of the pavilion, it was the Spanish engineers Carlos Morales and Manuel de Cos who developed the full building services project of the Pavilion of Spain at the New York World's Fair. Both are part of the team at 'Heredia & Moreno, SA Industrial Engineering, Chemistry and Civil' engineering¹³.

The following describes the process through which the 'Heredia & Moreno' engineering company became responsible for the building services of this project: this company was involved in the construction of the Crystal Palace of the Casa de Campo in Madrid, for which they drafted the building services and structures project. This project was entrusted to the architect Francisco Cabrero, who presented half a dozen plans to the builder with undefined installations, and with these data, the building had to be constructed in six months. This challenge, a project whose plans went from the engineering studio directly to the construction site, became a success for all participants, because they met the deadline with the required quality¹⁴. Furthermore, this engineering company had accurate knowledge of the American way of working, because it had been involved in engineering projects for various works in

¹¹ CARVAJAL, J. "J. Carvajal", op. cit, pp.79-80.

¹² FULLAONDO, J. D. Ídem, p.29.

¹³ In 1959 'Heredia Moreno', HEYMO, is established as Professionals Association. In 1964 the Professional Association is transformed into a corporation: 'Heredia Moreno SA' The activity of the company focuses to start in construction projects and landmark buildings, and from 1966, HEYMO extends its activity to industrial facilities plants and chemical plants, starting its activities in foreign markets with projects like the Duran-Quito pipeline in Ecuador, or the Melia Hotel in Baghdad (Iraq). It is noteworthy that in those years, all members of the company were technical engineers, with no architect on the team.

¹⁴ The air conditioning of the Crystal Palace is contracted directly to the builder, but HEYMO is responsible for field installation. As proof of their technical, HEYMO is the first company to place centrifugal compressors in Spain, in the pavilion of the House, but they put a week after the opening, as they are items that come directly from the United States and had problems with the delivery, the opening day got a provisional "that Franco could sneeze in the auditorium" to demonstrate, in some way, the display technology of the building. Conv. M. of Cós.

the USA bases at Rota and Moron for the U.S. Navy since 1960. Therefore, the English language and the US law were not an impediment, and they even had some contacts in the United States.

These prior circumstances reached the ears of the Commissioner of Spain of the New York World's Fair, who commented on the possibility of working with them, to Carvajal but with the background mentioned, actually Javier Carvajal 'should' hire them because they were considered the best choice for this project. After Javier Carvajal spoke with them, the working group for drafting the implementation of both structure and installations of the pavilion was formed.

Manuel de Cos defined the professional experience during the drafting of the project with Carvajal as the best he had had with architects. It was a smooth collaboration with continuous dialogue with Carvajal: Every week a few coordination meetings with the architect were held, and one of these meetings was for everyone involved in the project, with the objective of solving the problems on the drawing-board, without philosophies or reflections that would have slowed down the project execution. In these meetings the technicians came with a list of questions for Javier Carvajal, (for example: 'What can we do to have air conditioning here or there? ') And the architect, according to Manuel de Cos, always responded with appropriate solutions from the technical standpoint. It was, then, a comfortable and effective job, which opened the door to further collaboration.

This methodology the project to be fully completed in Madrid, and did not required adapting or significant modification when construction was begun in the United States. In the words of Manuel de Cos "it is a well-thought out and well-discussed installations project".

For the design of the pavilion building services, HEYMO handled the specific rules of the U.S. Army Contracting Offices, which - as mentioned - they had used before. But for issues related to air-conditioning, the reference used was ASHRAE, which was at the time a sort of complete technical handbook that the HEYMO engineers handled with ease. To complete this project, some particular specifications of the City of New York had to be fulfilled, but without involving substantial changes to the project.

Compared with American engineers, Manuel de Cós indicated they did not feel in inferiority of conditions technically nor did they have any complexes about it as they had prior knowledge, and the Spanish Pavilion was an opportunity to demonstrate what could be done internationally from Spain¹⁵.

¹⁵ "The reasons for our professional success in those years are because we are restless people, who knows and works with foreign references with knowledge, but we lacked the experiences which proves this". Conv. M. de Cós.

Regarding the cost of the building services in relation to the whole building, it did not bother either the architect or the draft engineers of the project, as they were responsible for making the best possible project, which meant comfortable economic freedom without limitations, however, this did not imply waste in the execution, construction or maintenance costs during the Fair.

The plans we analyzed of various building services in the pavilion came from two sources: the Archive ' Heredia & Moreno SA ' (with bilingual texts in Spanish and English), and the Historical Archive of the School of Architecture of the Universidad de Navarra (with English texts only). It is interesting to highlight how, when compared to the complex and bulky current building services projects, the construction of the Spanish Pavilion project required little more information than the plans and notes which we shall now discuss.

On the subject of the installation of plumbing and sanitation, it is defined with detailed axonometric drawings including the plumbing network and developed sections of pipes in relation to the metallic structure.

The electrical installation stands out above the rest (this fact is recorded in various sources consulted) for the outstanding artificial lighting used in the exhibition areas "in the showcases which are discreetly illuminated by aluminium lamps which prolong the same scheme as the coffered ceiling, the products, however insignificant, glow like jewels. "¹⁶

In these plans for electricity and lighting, the information is also detailed and complete, and the plans include the switches, the arrangement of the lights, their connection details, the single-line blueprints...

4. Hygrothermal conditioning building services

The initial decision to use air-conditioning on the premises was made between the Spanish engineering firm and the architect, according to their functional criteria. Neither the Commissioner of the Fair, nor other people or agencies were at any point responsible for deciding which areas must be conditioned. Thus, all exhibition areas have the same air supply, because they are open areas with a partitioning that does not reach the ceiling, ensuring uniform air treatment areas. The walkways are not air-conditioned.

In terms of energy, a thermal conditioning design of the pavilion was favored by the fact that at that time there was no concern for energy savings due to low fuel prices, either in the United States or in Spain.

¹⁶ RAMÍREZ DE LUCAS, J. "J. Carvajal. Arquitecto", op. cit, p.58.

The air conditioning project, according to Manuel de Cos, was affected not only by the minimum volume of air boost depending on the uses and occupants, but also by US fire and safety regulations. In any case, the peculiarities of the climate of New York, with high humidity in summer, did not pose any problem, since the control of both temperature and humidity of the building were proposed from the very beginning.

In relation to the primary loop and the secondary loop, the pavilion installation consisted of the following elements: a boiler and coolers that supplied hot and cooled water to the water treatment unit and to the air curtains. All these elements were monitored by a system to facilitate their management.

According to Manuel de Cos, the conditioning installation control was a relatively simple installation: it had a pneumatic system with thermostats connected to a switchboard that opened and closed valves, in which special attention was given to the general areas.

In one of the plans, the existence of “air outlets with volume control” is indicated, but although the installation noise limits were broad, these diffusers were placed because the engineers themselves wanted to meet US regulations.

The names of the manufacturers of the conditioning equipment were not conserved (air handling units, boilers, coolers, diffusers ...) but Manuel de Cos remembers that the air handling units were prefabricated, not built in situ. This was already commonplace in the US, although unusual in Spain at the time. In any case, logically, all the hygrothermal conditioning network equipment was American.

Regarding to the route of the supply lines, we should note the skilled strategy of J. Carvajal for integrating most of the bulky and heavy network ducts for air conditioning into the floor-space.

5. Conclusions

[Question] Do not you think the desire for universal architecture is almost impossible?

[Answer] Of course! A great mistake. That was one of the great discoveries that I personally made: the dogma of internationality is false. An international model can not be made. The urban, social and, of course, economic conditions, of each country impede it.¹⁷

As noted in the description of the generation process of the project, engineers began to gain the importance and recognition they deserve, although, of course, they must be supervised by an architect who cares about the integration of building services

¹⁷ CARRIZOSA, Susana. “Javier Carvajal. Bajo la soledad del exilio”, ‘Kilómetro Mapfre’, October 1994, pp.49 and ss.

over all. It is also noted how the technical parameters used (flow rates, supply and return temperatures, speeds, types of filters...) correspond fully with those used in projects of the period, represent and the consolidation of knowledge of this technology in Spain.

When Manuel de Cos was asked whether with means that existed at that time he would had done something different, he emphatically rejected the idea, since the technicians involved in the project had updated knowledge of what was done in the United States, and they designed the installation of air conditioning as well as they could with the knowledge and technical means of the time, which are different, of course, from what is currently available.

At an architectural level, the greatest contribution of the pavilion is the outstanding coordination of the design, the construction, the structure and equipment (including air conditioning) in a magnificent project, namely, awareness that building services are key components of great architecture.

IMAGE CAPTIONS

Fig.1. Cover of the documentation for the installation of air conditioning, plumbing and sanitation for the Spanish Pavilion at the New York's World Fair (Archive Heredia & Moreno SA).

Fig.2. Model of the Spanish Pavilion (School of Architecture of the University of Navarra). Photo. César Martín-Gómez

Fig.3. Downspouts plan (Archive Heredia & Moreno SA). These plans give full information in English and Spanish. On the cover, the plan is signed by Javier Carvajal and the technical office Heredia & Moreno, the person responsible being Manuel de Cos, and a space reserved for the conformity of the 'Spanish Commission of the Fair'. Note the detail of the layout of the downspout in relation to the walls and the metallic structure.

Fig.4. Plumbing plans of the entrance level (Archive Heredia & Moreno SA). Given the amount of information provided, this plan serves as reminder justifying the calculations of the plumbing network.

Fig.5. Electricity plan of the first floor (Part A, Historical Archives of the School of Architecture of the University of Navarra). These plans, with texts in English only, are signed by Javier Carvajal and Kelly & Gruzen ('consulting architects), in collaboration

with Lev Zetlin ('structural engineer') and Joseph R. Loring & Associates ('mechanical engineers') .

Fig.6. Ducted air conditioning on the entrance floor with the air handling unit (Archive Heredia & Moreno, SA). Notice how the lines fit in perfectly with the geometry indicated by the main architectural spaces.

Fig.7. Sections with air conditioning ducts (Archive Heredia & Moreno, SA).

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